

# AMENDMENTS TO THE CLAIMS

1. (Currently amended) A fluidized bed reactor for chlorinating zirconium and rutile sands to produce metals such as zirconium, hafnium and titanium ~~mixing a plurality of raw materials and transforming a chemical property of the raw materials to establish a desired product comprising:~~

a hollow, elongated, vertically oriented reactor housing for confining a reaction of the raw materials as they are transformed, a portion of the reactor housing confining the reaction of the raw materials defining a reaction zone;

a central chlorine gas and/or chlorine gas and solids inlet proximate the bottom of the reaction zone within the housing for directing chlorine gas and/or chlorine gas and solids in an upward direction along the vertical axis of the housing into the reaction zone without passing through a solid or perforated diffuser section to maintain the raw materials in suspension; and

a plurality of peripheral chlorine gas inlet jets positioned at at least two elevations along the elongated dimension of the housing for introducing chlorine gas at an angle to the elongated dimension of the housing to promote mixing of the raw materials in suspension;

a residue collection housing mating at one end with a lower portion of the reactor housing at the bottom of the reaction zone in fluid communication with the reaction zone and having an inclined lower wall for directing a reaction process residue from the reaction zone to a residue collection port through which the residue is extracted from the fluidized bed reactor; and

a sparger including a plurality of chlorine gas orifices positioned around at least a portion of the circumference of the interior of the residue collection housing and below the central chlorine gas or chlorine gas and solids inlet for introducing chlorine gas within the residue collection housing to maintain reaction process residue below a given size in suspension and directed back into the reaction zone while enabling agglomerates of reaction process residue above the given size to drop towards the collection port;

wherein the sparger chlorine gas orifices, the plurality of peripheral chlorine gas inlet jets and the central chlorine gas or chlorine gas and solids inlet are sized so the volume of chlorine gas emitted by each is a fixed predetermined ratio that

maintains good mixing, minimizes defluidization of the reaction products and promotes reaction of the reactant materials within the reaction zone.

2. (Currently amended) The fluidized bed reactor of claim 1 wherein the reactor housing has a conical section circumscribing the reaction zone with the reduced diameter of the conical section at its lower end interfacing with the chlorine gas and/or chlorine gas and solids inlet.

3. (Cancelled)

4. (Currently amended) The fluidized bed reactor of claim 3-1 including a feeder positioned at the residue collection port for removing the residue from the collection housing.

5. (Original) The fluidized bed reactor of claim 4 wherein the feeder is a screw or rotary feeder.

6. (Original) The fluidized bed reactor of claim 4 wherein the feeder continuously removes the residue from the reactor during operation.

7. (Cancelled)

8. (Currently amended) The fluidized bed reactor of claim 7-1 wherein the sparger gas is introduced at a downwardly directed angle to the central axis of the collection housing.

9. (Currently amended) The fluidized bed reactor of claim 7-1 wherein the incline of the lower wall of the residue collection housing is designed so that the gravitational forces on the residue above the given size will overcome the wall friction and travel to the collection port.

10. (Currently amended) The fluidized bed reactor of claim 1 wherein the plurality of peripheral chlorine gas inlet jets are directed at a downward angle to a line perpendicular to the central axis of the reactor housing.

11. (Cancelled)

12. (Currently amended) The fluidized bed reactor of claim 7-1 wherein the central chlorine gas or chlorine gas and solids inlet, the plurality of peripheral chlorine gas inlet jets and sparger are structurally formed so that approximately 30% of a

fluidizing chlorine gas is introduced through the central chlorine gas and/or chlorine gas and solids inlet, approximately 65% of the fluidizing chlorine gas is introduced through the plurality of peripheral chlorine gas inlet jets, and 5% of the fluidizing chlorine gas is introduced through the sparger.

13. (Currently amended) The fluidized bed reactor of claim 1 including control valves in fluid communication with a fluidizing chlorine gas supply and respective ones ~~or groups~~ of the plurality of peripheral chlorine gas inlet jets for individually controlling the quantity of chlorine gas passing through the respective plurality of peripheral chlorine gas inlet jets.

14. (Currently amended) The fluidized bed reactor of claim 1 wherein the plurality of peripheral chlorine gas inlet jets includes a plurality of chlorine gas jets at each of said-elevations respectively positioned around the circumference of the reactor housing.

15. (Currently amended) The fluidized bed reactor of claim 14 wherein the plurality of peripheral chlorine gas inlet jets at each elevation are equidistantly positioned around the circumference of the reactor housing.

16. (Currently amended) The fluidized bed reactor of claim 14 wherein the plurality of peripheral chlorine gas inlet jets at each elevation are not aligned with the jets at the other elevations.

17. (Original) The fluidized bed reactor of claim 4 wherein the feeder removes the residue from the reactor in batches during operation.

18. (Currently amended) The fluidized bed reactor of claim 1 wherein the plurality of peripheral chlorine gas inlet jets are positioned at at least three elevations.

19. (Currently amended) The fluidized bed reactor of claim 1 wherein the plurality of peripheral chlorine gas inlet jets are structurally formed so that the pressure drop across the plurality of peripheral chlorine gas inlet jets is at least 30% of the pressure drop across the reaction zone.

20. (Currently amended) The fluidized bed reactor of claim 7-1 wherein the sparger is structurally formed so that the pressure drop across the sparger is at least thirty percent of the pressure drop across the reaction zone.

21. (New) The fluidized bed reactor of Claim 1 wherein the reactor housing comprises graphite.